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(54) Title: TREATED BARK PRODUCT

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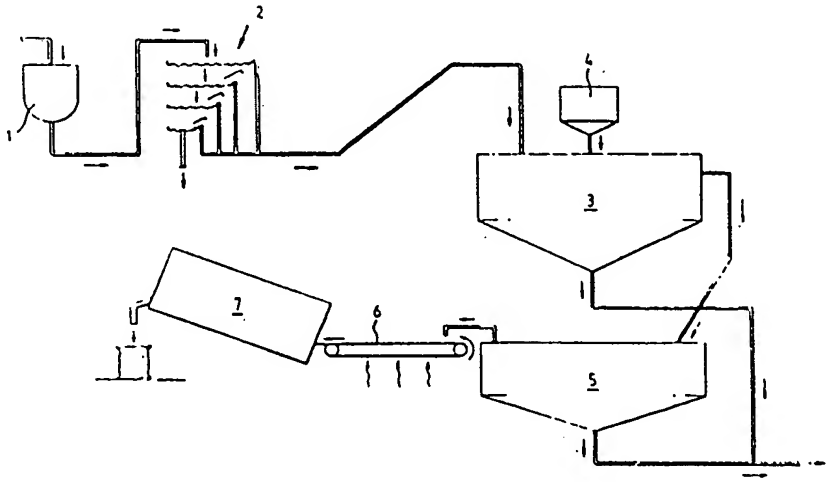

(57) Abstract

A plant growth medium is formed by granulating tree barks, heating the granular bark so formed to kill heat labile plant pathogens, chemically treating the granular bark with an aqueous solution of an alkali material to form at least a pH neutral outer layer on the granules and optionally impregnating the granules with trace elements, plant nutrients and fungicides. The heated, chemically treated bark granules are then immersed in cold water to cause separation of sapwood from the exogenous bark portion. The separated exogenous bark portion is then dried and bagged as a sterile plant growth medium particularly suited to aerophytes.

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In granulated pine bark growth medium is the presence of a layer of porous sapwood usually adhering to the exogenous bark layer. The sapwood layer absorbs a relatively large quantity of moisture and, over a period of time, is likely to undergo fungal degradation often with disastrous results for the plant being supported by the medium.

Although the invention is exemplified by reference to barks of the species pinus, it is considered that barks of many other commonly occurring species such as eucalyptus, acacia, grevillea and the like may be suitable for use with the method and apparatus of the invention with appropriate modifications if required.

According to one aspect of the invention there is provided a method for the manufacture of plant growth media from tree barks, said method comprising the steps of:-

treating granules of bark at an elevated temperature for a predetermined period of time to kill heat labile plant pathogens;

chemically treating said granulated bark with an alkali material to form at least an outer pH neutral layer on said bark granules;

immersing said heated, bark granules in water at ambient temperature or lower to cause separation of sapwood and exogenous portions of said granules of bark; and,

collecting and drying said exogenous portions.

Preferably said granulated bark is of a particle

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size in the range 3mm to 30mm.

Chemical treatment to effect substantial pH neutralization is suitably carried out with an alkaline material which may be selected from any suitable inexpensive and readily obtainable material such as sodium or calcium hydroxide or hypochlorite, quicklime, soda ash or the like.

Preferably the alkali material comprises crushed or powdered limestone or dolomite or a mixture thereof.

The chemical treatment process may also include impregnation of said particulate bark with trace elements, nutrients, fungicides, pesticides and the like, either singularly or in a preselected combination.

Heating of the particulate bark to kill heat labile plant pathogens may be carried out by any suitable means such as a hot air oven, a steam oven, radiant heaters, microwave heating radiation. Preferably heating is effected by heating the bark granules in water at atmospheric or elevated pressures in a pressure vessel.

Suitably the chemical treatment step is carried out simultaneously with the heating step although the treating and chemical treatment steps may be carried out independently.

Chemical treatment is suitably carried out within the temperature range 50^0C - 105^0C, preferably 95 - 103^0C.

According to another aspect of the invention there is provided an apparatus for manufacture of treated

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bark products, said apparatus comprising:-

a chemical treatment vessel including means to heat a volume of liquid contained therein;

conveyor means adapted to move particulate bark through said chemical treatment vessel at a predetermined rate;

a separation vessel containing, in use, a volume of unheated water;

transfer means to transfer treated particulate bark from said chemical treatment vessel to said separation vessel; and,

collection means to collect particles of chemically treated exogenous bark from said separation vessel.

Preferably said chemical treatment vessel comprises a rectangular chamber with an inlet region and outlet region respectively at opposed ends of said chamber.

Suitably said conveyor means is adapted to move particulate bark material between said inlet region and said outlet region at a predetermined rate.

The conveyor means may be adapted to agitate said particulate bark material as it moves between said inlet region and said outlet region.

According to yet another aspect of the invention there is provided an apparatus for manufacture of treated bark products, said apparatus comprising:-

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heating means adapted to heat particulate bark for a predetermined period of time to kill heat labile plant pathogens associated therewith;

a chemical treatment vessel to receive heat treated particulate bark, said chemical treatment vessel including conveyor means to move particulate bark through said chemical treatment vessel at a predetermined rate;

a separation vessel containing in use a volume of unheated water;

transfer means adapted to transfer chemically treated bark from said chemical treatment vessel to said separation vessel; and,

collection means to collect chemically treated exogenous bark from said separation vessel.

In order that the invention may be more readily understood, reference will now be made to preferred embodiments illustrated in the accompanying drawings in which

Fig 1 shows a flow chart illustrating the method according to the invention,

Fig 2 shows a schematic view of an apparatus according to the invention,

Fig 3 shows a schematic view of an alternative form of an apparatus according to the invention.

In Fig 1, saw mill waste such as pine bark is granulated in a hammer mill 1 and is then graded into selected particle size ranges by passing through a series of

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graded screens 2. A suitable range of particle sizes may be between say 6mm and 30mm in 6mm steps.

After grading into suitable particle size ranges the particle size ranges the particulate bark with attached sapwood is fed into a reaction vessel 3 containing an aqueous suspension of pulverized limestone or a mixture of pulverized limestone and dolomite. The particulate bark is maintained in the reaction vessel 3 with gentle agitation to allow neutralization of at least the surface layer of the bark which is acidic due to the presence of tannins, etc.

During the neutralization process one or more trace elements 4 may be added to the reaction vessel 3. The trace elements are selected according to the intended purpose of the treated bark material. For example with bark particles of smaller size these may be employed as a propagation medium in seed germination and early seedling stages and thus the nature and quantity of trace elements will be selected according to known criteria. Bark particles of larger size may be employed in later growth stages and will also be treated according to known criteria.

After a suitable reaction time in vessel 3, the neutralized bark, impregnated with trace elements is fed into a container 5 of clean unheated water. As the hot particulate bark starts to cool, the sapwood separates from the exogenous bark and settles to the bottom of container 5. This is believed to occur due to differentials in thermal

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expansion and water absorption between the sapwood and exogenous bark. The sapwood and the neutralization waste, a heavy red-brown liquid containing unspent limestone, and some wood chips are combined and, if required, may be utilized as a mulch for crops or other plants.

The treated exogenous bark particles are then placed on a mesh conveyor 6 to allow initial drainage before being dried in a rotary kiln 7. After drying the particulate bark is hermetically sealed in plastic bags or the like to prevent ingress of contaminants, particularly of the bacterial or fungal kind.

The product according to the process comprises a graded particulate exogenous bark product which is substantially pH neutral at least on the surface layer of the particles and is packaged in a clean sterile form. If required the product may be impregnated with trace elements or other plant nutrients.

Fig 2 illustrates one embodiment of an apparatus for substantially continuous production of treated bark.

Graded pulverized bark mill waste is fed via hopper 10 onto a conveyor belt 11 for transfer to reaction vessel 12 at a predetermined feed rate. Feed rate may be controlled or varied by any suitable means such as a rotary feeder 13 on hopper 10 or adjusting the speed of conveyor 11 or both.

A further hopper 14 contains a mixture of pulverized limestone and magnesium silicate and this

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powdered material is metered onto the conveyor belt 11 by means of a vibratory feeder 15.

Reaction vessel 12 is substantially filled with water which is maintained at or near 100^0C by a fuel fed boiler (not shown).

As the particulate bark is added to the reaction vessel it floats on the surface of the aqueous limestone suspension within the tank. The floating layer of bark is conveyed from one end of the vessel to the other at a predetermined rate by a walking beam conveyor 23 which momentarily elevates a layer of bark above the water surface as the layer progresses forwardly towards the outlet end of the vessel 12. Conveyor 23 comprises a plurality of rotating cranks 24 connected via link arms 25 to a bed 26 in the form of a wire mesh rack, timber platform or the like.

The oscillatory motion of the walking beam conveyor 23 not only serves to control the duration of treatment of the bark in reaction vessel 12, it also serves to continuously agitate the bark particles to ensure complete and even chemical treatment.

Located in the base of vessel 12 is a chain scraper 17 comprising spaced slats 18 extending between chain and sprocket drives 16 on each side of vessel 12. As the bark particles progress along the surface of the water in vessel 12, particles of sapwood, dirt and other contaminants sink to the floor of vessel 12. The reaction product of the

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limestone and the soluble acidic components of the bark settles to the floor of vessel 12 as a viscous red-brown liquid containing at least some unreacted limestone.

Reaction time in the reaction vessel is dependent upon surface area of the bark particles. For finer grades having an average particle size around 6mm, a residence time of about 10 minutes is sufficient to neutralize the acidic bark residues, impregnate with trace elements and to sterilize the bark. For larger particles sizes of say, 30mm, residence time of up to one hour may be required to fully treat the bark.

The combined effects of walking beam conveyor 23 and chain scraper 17 transfer the treated bark particles and the reaction vessel residues, under the influence of gravity, to a separation vessel 19 containing clean, unheated water at ambient temperature. As the hot treated bark particles come into contact with the cold water the exogenous bark portion separates from the sap wood portion and the latter sinks to the floor of vessel 19 while the exogenous bark portion ntinues to float.

A perforated belt conveyor 20 removes from one end of vessel 19 the exogenous bark particles, impregnated with one or more selected trace elements or other plant nutrient media, while sedimentary residues are removed by a chain scraper 21 or the like.

The exogenous bark particles are then dried in a

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suitable drying apparatus such as a rotary kiln, grain dryer or the like prior to bagging. The drying and bagging operations are carried out immediately after the separation step to remove the sapwood to maintain the sterility of the treated bark product.

Fig 3 shows an alternative embodiment of the apparatus of the invention wherein the heating of the bark and chemical treatment are carried out as separate steps.

The apparatus is substantially identical to that illustrated in Fig 2 except that the bark and pulverized limestone/magnesium silicate on conveyor belt 11 travel through a heating chamber 30 before entering reaction vessel 12.

The heating chamber 30 may include radiant heaters, a source of heated air or superheated steam or microwave radiation (or a combination of heating methods) to elevate the temperature of the bark particles to a degree and for a period sufficient to kill heat labile plant pathogens associated with the bark. Depending on the size of the bark particles, a residence time of from 15 min to 1 hour in an atmosphere of heated air or superheated steam will be sufficient to kill most unwanted pathogens, however this residence time may be substantially reduced where heating is effected by microwave radiation, particularly if the bark is sprayed with water before entering the heating chamber.

The reaction vessel 12 need not be heated in this

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embodiment as residual heat from the heated bark particles is sufficient to elevate the temperature of the aqueous neutralization/impregnation liquor to assist in the rate of reaction of the neutralization and impregnation processes.

Similarly, if a microwave heater is employed to dry the treated exogenous bark issuing from separation vessel 19, the period of the drying cycle may be reduced and any residual heat labile pathogens are killed. This may permit reduction of the period of the initial heating cycle.

The treated bark product produced according to the invention is a particularly suitable growing/propagation medium for delicate aerophytes such as orchids and the like. The particulate bark material is pH neutral and is free of any bacteria or fungi which could adversely affect plant growth. The treatment process according to the invention removes soil particles and other contaminants which could harbour plant pathogens and the removal of the highly water absorbent sapwood component largely alleviates subsequent fungal attach from airborne fungus spores.

Depending upon the nature of the plant to be grown in the product according to the invention, selected trace elements or other plant nutrients may be incorporated to suit the particular requirements of different plants at different growth stages.

It will be clear to a skilled addressee that many modifications and variations may be made to the invention without departing from the spirit and scope thereof.

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CLAIMS

1. A method for the manufacture of plant growth media from tree barks, said method comprising the steps of:-

heating granules of bark at an elevated temperature for a predetermined period of time to kill heat labile plant pathogens;

chemically treating said granulated bark with an alkali material to form at least an outer pH neutral layer on said granules;

immersing said heated bark granules in water at ambient temperature or lower to cause separation of sapwood and exogenous portions of said granules, and;

collecting and drying said exogenous portions.

2. A method as claimed in claim 1 wherein said steps of heating the granules and chemically treating the granules are carried out simultaneously.

3. A method as claimed in claim 1 wherein said steps of heating the granules and chemically treating the granules are carried out as separate steps.

4. A method as claimed in any preceding claim wherein the bark granules have a particle size in the range 3mm to 30mm.

5. A method as claimed in any preceding claim wherein the alkali material comprises powdered limestone, powdered dolomite or a mixture thereof.

6. A method as claimed in any preceding claim wherein

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the chemical treatment step also includes impregnation of said bark granules with trace elements, plant nutrients, fungicides, pesticides or any combination thereof.

7. A method as claimed in any preceding claim wherein the chemical treatment step is carried out in the temperature range of from 50^0C - 105^0C.

8. An apparatus for the manufacture of plant growth media from tree barks, said apparatus comprising:-

heating means to heat granulated bark at an elevated temperature for a predetermined period of time to kill heat labile plant pathogens;

a reaction vessel to chemically treat said granulated bark;

conveyor means adapted to move granulated bark through said reaction vessel at a predetermined rate;

a separation vessel containing, in use, a quantity of water at ambient temperature or lower;

transfer means to transfer chemically treated granules of bark from said reaction vessel to said separation vessel; and,

collection means to collect exogenous bark separated from sapwood in said separation vessel.

9. An apparatus as claimed in claim 8 wherein said heating means comprises a heated aqueous solution in said reaction vessel.

10. An apparatus as claimed in claim 8 wherein said

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INTERNATIONAL SEARCH REPORT

International Application No. PCT/AU 90/00369

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) 6

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl. C09K 17/00

II. FIELDS SEARCHED

Minimum Documentation Searched 7

Classification System	Classification Symbols
IPC	C09K 17/00, C05G 3/04, A01G 1/00, 7/00

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched 8

AU : IPC as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT 9

Category*	Citation of Document, 11 with indication, where appropriate, of the relevant passages 12	Relevant to Claim No 13
Y	US,A, 4804401 (WAHLBERG et al) 14 February 1989 (14.02.89) See claims 1-14	(1-12)
Y	CA,A, 1203991 (SOCIETE FRANCAISE D'AGREGATS STABILISES) 6 May 1986 (06.05.86) See claims 1-8	(1-12)
Y	DE,A, 3334540 (EBS HOLZKRAFT GMBH & CO KG) 11 April 1985 (11.04.85) See claims 1-8	(1-12)
Y	EP,A, 104355 (CHEMIE LINZ A.G., LENTIA GMBH) 4 April 1984 (04.04.84) See claims 1-9	(1-12)
Y	AU,B, 60945/80 (520873) (N.Z. FOREST PRODUCTS LTD) 6 November 1980 (06.11.80) See claims 1-6	(1-12)

(continued)

* Special categories of cited documents: 10

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
5 November 1990 (05.11.90)	26 November 1990
International Searching Authority	**Signature of Authorized Officer**
Australian Patent Office	R.A. MELVIN

Form PCT/ISA/210 (second sheet) (January 1985)

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FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

P,A	EP,A, 360447 (CAMLAND PRODUCTS LTD) 28 March 1990 (28.03.90)	

V. [ ] OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE 1

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.[ ] Claim numbers ..., because they relate to subject matter not required to be searched by this Authority, namely:

2.[ ] Claim numbers , because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3.[ ] Claim numbers ..., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4 (a):

VI. [ ] OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING 2

This International Searching Authority found multiple inventions in this international application as follows:

1.[ ] As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2.[ ] As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3.[ ] No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. [ ] As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

[ ] The additional search fees were accompanied by applicant's protest.

[ ] No protest accompanied the payment of additional search fees.

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